REMARKS

Claims 1, 7-12, and 22, remain pending in this application.

The Examiner rejected claims 1, 7-12, and 22, under 35 U.S.C. § 103(a) as being unpatentable over U.S. Patent No. 6,428,673 (***Ritzdorf***) in view of U.S. Patent No. 6,221,765 (***Ueno***) and U.S. Patent No. 6,298,470 (***Breiner***). Applicants respectfully traverse this rejection.

In the Final Office Action Dated October 25, 2004, the Examiner stated that Applicants ignored that ***Ritzdorf's*** (U.S. Patent No. 6,428,673) use of metrology to control copper deposition. *See*, Final Office Action Dated October 25, 2004, page 9. Applicants respectfully assert that Applicants did not ignore any aspect of ***Ritzdorf***, instead Applicants merely pointed out that ***Ritzdorf*** does not disclose forming an opening upon a first dielectric layer that is formed above a structure upon which the copper layer is formed and controlling a parameter based upon a measured thickness, as called for by claims of the present invention. Also, Applicants have pointed out that ***Ritzdorf*** does not disclose averaging the thickness from a plurality of sites on a copper layer as called for by claims of the present invention. ***Ritzdorf*** discloses that a metrology system can feed forward or feed back uniformity and thickness data to drive a process rpecipe for electroplating reactors. *See*, col. 4, lines 38-41. However, this neither reads upon forming an opening upon a first dielectric layer that is formed above a structure upon which the copper layer is formed and controlling a parameter based upon a measured thickness; nor does it read upon averaging the thickness from a plurality of sites on a copper layer, as called for by claims of the present invention. Other art cited by the Examiner does not provide disclosure sufficient to make

obvious all of the elements of the claims of the present invention that are not disclosed or suggested by ***Ritzdorf***.

In the Final Office Action Dated October 25, 2004, the Examiner stated that Applicants are attempting to show non-obviousness by attacking references individually. Applicants respectfully disagree. Applicants are not interested in attacking the prior art references individually; Applicants merely pointed to various deficits of the prior art references that are not made up for by the primary reference (***Ritzdorf***). The Examiner attempted to piece together an obviousness argument by extracting various disclosures from three separate prior art references. Applicants merely pointed out that these references have various individual deficits of subject matter, that when combined, all of the elements of claims of the present invention would not be made obvious.

Regarding U.S. Patent No. 6,221,765 (***Ueno***), in the Final Office Action Dated October 25, 2004, the Examiner stated that Applicants distorted the rejection by stating that ***Ueno*** does not disclose modifying a parameter by measuring a stress, which is an element that the Examiner uses ***Ueno*** to provide. *See*, Final Office Action Dated October 25, 2004, page 10. Then, the Examiner stated that ***Ueno*** is provided for showing why knowing the specific quantity of stress is important, which would lead one of ordinary skill in the art, based upon disclosure in ***Ritzdorf***, to make obvious the element of "measuring a stress." Therefore, this amounts to using ***Ueno*** in combination with ***Ritzdorf*** to make obvious the element of "measuring a stress." Accordingly, Applicants are still correct in stating that the Examiner is using ***Ueno*** (in combination with

Ritzdorf) to provide the missing element of "measuring a stress". Hence, Applicants respectfully assert that Applicants did not distort the rejection provided.

Contrary to the Examiner's assertion (in the Final Office Action Dated October 25, 2004), ***Ueno*** does not show why knowing the specific quantity of stress in a copper layer is important, ***Ueno*** merely points out that residual tensile stress may be present and makes a guess that the stress may be the result of shrinking of a plating film. *See*, col. 3, lines 33-37. Simply because ***Ueno*** describes a guess as to why residual tensile stress is present and because ***Ritzdorf*** discloses "other parameters" being measured, it does not follow that cited prior art provides sufficient motivation to one of ordinary skill in the art to measure a stress parameter (along with other elements of claims of the present invention). Therefore, Applicants' argument that ***Ueno*** does not provide sufficient motivation or incentive to make obvious the element of "measuring a stress" still holds true. Furthermore, Applicants submit that one skilled in the art would not make obvious the element of "measuring a stress" in the context of claims of the present invention simply because ***Ueno*** merely discloses that tensile stress may occur as a result of shrinkage of plating film, and simply because ***Ritzdorf*** merely discloses film thickness along with "other measurements"; the combination of which does not make obvious varying a parameter in response to thickness differing from desired thickness and mechanical stress. There is no evidence presented to the contrary. Additionally, even if ***Ritzdorf*** and ***Ueno*** were combined with ***Breiner***, this element of the present invention would still not be made obvious.

Regarding ***Breiner***, in the Final Office Action Dated October 25, 2004, the Examiner asserts that Applicants' arguments regarding ***Breiner*** are based upon a false premise. *See*, page 10 of the Final Office Action Dated October 25, 2004. Applicants respectfully disagree. The

Examiner makes this assertion by agreeing with Applicants that the number of points referenced in ***Breiner*** refers to the number of positions in the fabrication process, and not to the number of points on the semiconductor wafer itself; and adds that ***Breiner*** also states that the data may include multiple measurements of each point. However, Applicants respectfully assert that this disclosure in ***Breiner*** does not contradict Applicants' contentions. The disclosure of multiple measurements for each data point in ***Breiner*** does not refer to averaging a plurality of thicknesses from a plurality of locations on a copper layer, as called for by claims of the present invention (see Col. 4, lines 62-63); instead, it refers to more than one measurement of "each data point". This disclosure in ***Breiner*** is preceded by a phrase that supports Applicants' argument. The term "mean value" is put into context by the preceding phrase "multiple measurements for each data point," which suggests a mean or median value for the multiple measurements for each data point and not to the same measurements of different data points (see, col. 4, lines 61-65). Hence, ***Breiner***, along with the cited prior art, does not make obvious the element of averaging a plurality of thicknesses from a plurality of locations on a copper layer, as called for by claims of the present invention.

Additionally, in the Final Office Action Dated October 25, 2004, the Examiner stated that Applicants' description of the term "wafer map" is based upon a false premise. *See*, page 11 of the Final Office Action Dated October 25, 2004. Applicants respectfully disagree. When reading the disclosure of ***Breiner*** in proper context, the term "wafer map" in ***Breiner*** indeed refers to a reference electrical testing, and the Examiner does not offer any evidence to the contrary. The term "wafer map" is *specifically separated* to discuss electrical testing and refers to electrical test characteristics, such as breakdown voltages, leakage currents, resistivity, *etc.*,

(emphasis added). ***Breiner*** discloses using such data to provide a wafer map relating to electrical responses related to the geography of the semiconductor wafer (see item numbers 8 and 9 on col. 4, lines 48-59). There is no evidence in any of the cited prior art references to suggest or make obvious a wafer map relating to the thickness across various portions of the semiconductor wafer. These arguments are provided in more detail below.

Applicants respectfully assert that ***Ritzdorf*** in combination with ***Ueno*** and ***Breiner*** does not disclose or make obvious all of the elements of claim 1 of the present invention. ***Ritzdorf*** does not teach, disclose, or make obvious, all of the elements of claim 1, 7-12, and 22. ***Ritzdorf*** is directed towards a system for receiving a wafer for processing, *e.g.*, electrical chemical plating. ***Ritzdorf*** discloses forming a seed layer upon a wafer and transporting the wafer for further analysis or processing. *See*, col. 9, lines 52-55, col. 10, lines 14-16. However, ***Ritzdorf*** does not disclose forming an opening upon a first dielectric layer that is formed above a structure upon which the copper layer is formed and controlling a parameter based upon a measured thickness as called for by independent claims 1 and 22 of the present invention.

Furthermore, ***Ritzdorf*** does not disclose averaging the thickness from a plurality of sites on a copper layer as called for by claims 1 and 22 of the present invention. Controlling a parameter in response to the thickness data that is averaged from data relating to a plurality of positions are not taught by ***Ritzdorf*** and this deficit is not made up for by ***Ueno*** and/or ***Breiner***. Additionally, neither ***Ritzdorf***, ***Ueno***, nor ***Breiner*** disclose measuring a mechanical stress relating to the first copper layer and varying a parameter to form the first copper layer in response to the actual thickness differing from the desired thickness and the mechanical stress.

The Examiner cites ***Ueno*** to disclose the mechanical stress element of claims 1 and 22. However, ***Ueno*** merely discloses a compressive stress being generated in a film to allow a stress to act in a direction enhancing shrinkage of the plating film. *See,* col. 3, lines 33-37. The plating film disclosed in ***Ueno*** is formed while distorting the semiconductor substrate into a concave. *See,* col. 3, lines 37-39. Therefore, the plating film, in which the compressive stress is generated, is formed in an attempt to prevent void generation. *See,* col. 3, lines 39-47. However, measuring the mechanical stress of a copper layer to modify a parameter used to form the copper layer is not disclosed by ***Ueno***. The compression stress applied by ***Ueno*** is merely performed to prevent void generation. The Examiner uses ***Ueno*** to disclose the missing element of modifying a parameter by measuring a stress, which is indeed not provided by ***Ueno***.

Ueno is merely directed to distorting the semiconductor substrate into a concave to introduce compressive stress to prevent void generation. Therefore, one skilled in the art would not combine the disclosure of ***Ueno*** with ***Ritzdorf*** to call for or make obvious the element of measuring the mechanical stress and varying the parameter based upon the actual thickness differing from the desired thickness and the mechanical stress as called for by claims 1 and 22 of the present invention. Furthermore, even with the combination of ***Ueno***, elements other than measuring the mechanical stress are missing from the combination of ***Ueno*** with ***Ritzdorf***, and ***Breiner*** does not make up for this deficit, as described below.

Applicants respectfully assert that the term "multiple measurements for each data point," in ***Breiner***, as used by the Examiner, does not refer to a plurality of measurements at different points on a semiconductor wafer. The evidence and reasoning for support of this assertion is provided below. When examining this phrase, one skilled in the art would not ignore the

disclosure in ***Breiner*** that actually sheds light to this phrase. As disclosed in ***Breiner***, the "number of points" reference in ***Breiner*** refers to the number of positions in the fabrication process, not the number of points on the semiconductor wafer itself (the evidence for supporting this statement is in col. 4, lines 14-15). Additionally, the term "wafer map" is specifically separated to discuss electrical testing and refers to electrical test characteristics, such as breakdown voltages, leakage currents, resistivity, *etc.* ***Breiner*** discloses using such data to provide a wafer map relating to electrical responses related to the geography of the semiconductor wafer (see item numbers 8 and 9 on col. 4, lines 48-59). Nothing in ***Breiner***, or in the other cited prior art, suggests a wafer map relating to the thickness across various portions of the semiconductor wafer.

Although ***Breiner*** discloses wafer thickness, ***Breiner*** actually points to using wafer maps for electrical testing. ***Breiner*** intentionally omits the discussion of wafer maps when discussing other types of data, such as deposition data, etch data, photolithography data, CMP data, and implant data (see items listed on col. 4, lines 18-59). In a parallel list that discusses various types of data, ***Breiner*** intentionally leaves out the term "wafer map" when discussing all items, except for discussions of the electrical test. Therefore, ***Breiner*** actually suggests only using wafer maps for electrical type data. Therefore, ***Breiner*** actually teaches away from the claimed invention.

Additionally, ***Breiner*** only provides a passing reference to a "mean" value of data points, as described above, ***Breiner*** does not disclose measuring the thickness of copper layers at a plurality of locations on the copper layer and averaging the resultant data, as called for by the claims of the present invention. Again, the term "mean value" is put into context by the preceding term "multiple measurements for each data point," which suggests a mean or median

value for the multiple measurements for each data point and not to the same measurements of different data points (see, col. 4, lines 61-65). Furthermore, claims 1 and 22 (as amended) also call for measuring a mechanical stress and modifying a parameter relating to forming a copper layer, which is not disclosed or made obvious by the cited prior art. Support for these amendments may be found in the specification, for example, see page 12 of the specification. Therefore, ***Breiner*** clearly does not disclose or make obvious all of the elements of the claimed invention. Accordingly, combining ***Ritzdorf***, ***Ueno***, and ***Breiner***, still would not make obvious all of the elements of claims 1 and 22 of the present invention. Therefore, for at least the reasons cited above, claims 1 and 22 are allowable.

Independent claims 1 and 22, are allowable for at least the reasons cited above. Additionally, dependent claims 7-12, which depend from independent claim 1 are also allowable for at least the reasons cited above.

The Examiner rejected claims 1, 7, 8, 10, 11, and 22, under 35 U.S.C. § 103(a) as being unpatentable over U.S. Patent No. 6,428,673 (***Ritzdorf***) in view of U.S. Patent No. 6,221,765 (***Ueno***) and U.S. Patent No. 6,211,094 (***Jun***). Applicants respectfully traverse this rejection.

The Examiner combines ***Ritzdorf*** and ***Ueno*** with ***Jun*** to reject claims 1, 7, 8, 10, 11, and 22; however, Applicants respectfully traverse this rejection. As described above, ***Ritzdorf*** does not disclose all of the elements of claims 1 and 22 of the present invention and the disclosure of ***Ueno*** and ***Jun*** would still not make up for this deficit. For example, as described above, ***Ritzdorf*** does not teach the averaging element or measuring of the mechanical stress to modify a

parameter. The compressive stress disclosed by ***Ueno*** still does not make up for this deficit, as described above. Additionally, the Examiner cites ***Jun*** to assert obviousness of the element of averaging the plurality of thickness to form a plurality of locations. However, ***Jun*** merely discloses measurement of wafers that are analyzed for thickness at various zones. Applicants respectfully assert that ***Jun*** does not disclose averaging the plurality of thicknesses from a plurality of locations on the copper layer, as called for by claims 1 and 22 of the present invention. ***Jun*** does not disclose comparing the actual thickness to a desired thickness as called for by claims 1 and 22 of the present invention. Furthermore, ***Jun*** does not disclose measuring the mechanical stress relating to a copper layer and, as described above, this element is not disclosed or made obvious by ***Ritzdorf*** or ***Ueno***. Therefore, adding the disclosure of ***Jun*** to ***Ritzdorf*** and/or ***Ueno*** still would not disclose or make obvious all of the elements of claims 1 and 22 of the present invention. Therefore, claims 1, 7, 8, 10, 11, and 22, are not disclosed or made obvious by ***Ritzdorf, Jun, Ueno*** or their combination, for at least the reasons described above. Therefore, claims 1, 7, 8, 10, 11, and 22 are allowable for at least the reasons cited above.

Independent claims 1 and 22, are allowable for at least the reasons cited above. Additionally, dependent claims 7, 8, 10, and 11, which depend from independent claim 1 is also allowable for at least the reasons cited above.

Reconsideration of the present application is respectfully requested.

In light of the arguments presented above, Applicants respectfully assert that claims 1, 7-12, and 22 are allowable. In light of the arguments presented above, a Notice of Allowance is respectfully solicited.

If for any reason the Examiner finds the application other than in condition for allowance, the **Examiner is requested to call the undersigned attorney** at the Houston, Texas telephone number (713) 934-4069 to discuss the steps necessary for placing the application in condition for allowance.

Respectfully submitted,

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